

DOCUMENT RESUME

ED 184 128

CS 205 437

AUTHOR Robertson, Gladene
 TITLE A Comparison of Meaningful and Nonmeaningful Content in Computer-Assisted Spelling Programs. S. S. T. A. Research Centre Report No. 51.
 INSTITUTION Saskatchewan School Trustees Association, Regina.
 PUB DATE Apr 78
 NOTE 22p.
 AVAILABLE FROM Saskatchewan School Trustees Association Research Centre, 570 Avord Tower, Regina, Saskatchewan, Canada (\$1.00)
 EDRS PRICE MF01/PC01 Plus Postage.
 DESCRIPTORS Academic Achievement: *Arithmetic: *Computer Assisted Instruction: *Educational Research: Elementary Education: Grade 3: *Remedial Instruction: Spelling: *Spelling Instruction: *Visual Discrimination

ABSTRACT

Thirty-six third grade students, identified as the poorest spellers in their grade in three schools in Saskatoon (Canada), were selected to participate in a study of computer assisted spelling programs. Two groups used computer assisted spelling programs, one emphasizing meaningful words, the other nonmeaningful words; while a third group used a computer assisted arithmetic program. Findings indicated that compelling children to observe the detail of a sequence appeared to be a useful remedial spelling technique whether the sequence was a meaningful or a nonmeaningful letter sequence or the sequence of a number equation, since all three groups gained an average of 5.6 months over a five-week period. Additionally there was no interaction between treatment and visual sequencing ability. In comparing the pattern of errors made in pretest and posttest situations, no significant difference was found between the three treatment groups. An additional finding was that children who were frustrated with failure in the classroom responded positively to the challenge of computer assisted programs presented on teletype terminals. (MKM)

 * Reproductions supplied by EDRS are the best that can be made *
 * from the original document. *

ED184128

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY.

A COMPARISON OF MEANINGFUL AND NONMEANINGFUL
CONTENT IN COMPUTER-ASSISTED
SPELLING PROGRAMS

Gladene Robertson, M.Ed.

S.S.T.A. Research Centre Report No. 51

A report with recommendations prepared under the auspices of
the Saskatchewan School Trustees Association Research Centre.

April, 1978

"PERMISSION TO REPRODUCE THIS
MATERIAL HAS BEEN GRANTED BY

Saskatchewan School
Trustees Association

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)."

Note: The opinions expressed in this report are those of the author and may or may not be in agreement with SSTA officers or trustees, but are offered as being worthy of consideration by those responsible for making decisions.

Price to Public \$1.00

THE RESEARCH CENTRE
SASKATCHEWAN SCHOOL TRUSTEES ASSOCIATION
570 AVORD TOWER, REGINA, SASKATCHEWAN

CS225437

INFORMATION ABOUT THE PROJECT LEADER

1. Business address and telephone number where the Project Leader may be contacted:

Institute of Child Guidance and Development
University of Saskatchewan
Saskatoon, Saskatchewan S7N 0W0
Telephone: 343-2077

2. Time of day most suitable for telephone calls:

Messages may be left at any time during the day.

3. Present occupation of the Project Leader:

Assistant Professor of Education

TABLE OF CONTENTS

A. The Most Important and Significant Findings and/or Implications of the Study	1
B. Purposes of the Study	1
C. Procedures and Sample	2
D. Findings	8
E. Conclusions and Implications	16

A COMPARISON OF MEANINGFUL AND NONMEANINGFUL CONTENT IN COMPUTER-ASSISTED SPELLING PROGRAMS

A. THE MOST IMPORTANT AND SIGNIFICANT FINDINGS AND/OR IMPLICATIONS OF THE STUDY

1. Compelling children to observe the detail of a sequence appeared to be a useful remedial spelling technique whether the sequence was a meaningful or a nonmeaningful letter sequence, or the sequence of a number equation.
2. Children who were frustrated with failure in the classroom responded positively and with enjoyment to the challenge of computer-assisted programs presented on teletype terminals.
3. Reliance on one test administration as the basis on which a child's spelling errors may be analyzed regarding a pattern of auditory or visual weakness may be suspect.
4. The Visual Sequential Memory (VSM) subtest of the Illinois Test of Psycholinguistic Abilities (ITPA) did not appear to be a useful tool in predicting spelling ability.

B. PURPOSES OF THE STUDY

This research study had a three-fold purpose:

- to compare the use of meaningful and nonmeaningful materials in computer-assisted remedial spelling programs.

— to determine the degree to which attainment in a particular program was dependent upon the visual sequencing abilities of the child.

— to analyze the types of spelling errors made by each child prior to and after treatment.

C. PROCEDURES AND SAMPLE

Two hundred and fifty-six Grade Three children in four Saskatoon schools were given a modified form of the Schonell S1 Spelling Test (S-S1A) as a screening device to select poor spellers. A spelling quotient for each child was established and the children who ranked as the bottom twelve in each school were chosen for the study (see Table 1).

Table 1

Distribution of Subjects by School,
Room, and Spelling Quotient

School	No. of Gr. 3 rooms	No. of children in each room	Number selected	SQ range
A	2	35	2	80-93
		32	10	73-93
B	2	35	8	71-92
		8	4	76-92
C	2	24	5	86-88
		23	7	60-92
D	4	32	2	80-89
		31	4	82-91
		19	1	87
		17	5	73-91
Total	10	256	48	60-93

One school was dropped from the study to ensure a more uniform age range among the subjects. The VSM of the ITPA was administered. On the basis of their VSM scores the children were matched in threes and randomly assigned to two experimental (Words and Letters) and one control (N Facts) group (see Table 2).

Table 2

Mean Chronological Age, Spelling Age and Spelling Quotient by School and Treatment Group

Group	Mean CA		Mean SA		Mean SQ
	Yr.	Mo.	Yr.	Mo.	
School A	8	4	7	1	92.67
School B	8	11	7	6	84.25
School C	8	8	7	3	84.58
Words	8	5	7	5	87.58
Letters	8	8	7	3	84.75
N Facts	8	9	7	3	82.08

VSM scores were used to divide the children into two groups. Those children obtaining the lowest eighteen scores were the V- group and those with the eighteen highest scores became the V+ group (see Table 3).

Form A of the Gates McKillop Spelling Test was individually administered to each of the thirty-six children. The procedure of the test was changed in that the responses were written rather than given verbally. All errors made on the Gates-McKillop, Form A were analyzed and classified according to a General Category Analysis of Errors while

the errors made by the subjects on the S-S1A were labelled by both the General Category Analysis and the Specific Error Classification (see Tables 4 and 5).

Table 3

Ranked VSM Scores Showing Means and Standard Deviations for V+ and V- Groups

Group	Raw Score	Mean	SD
V+	29		
	28		
	27		
	26		
	26		
	25		
	25		
	24		
	23		
	22		
	22		
	22		
	21		
	21		
	20		
	20		
	20		
	20	23.3889	2.87013
V-	20		
	19		
	19		
	19		
	19		
	19		
	19		
	18		
	18		
	18		
	18		
	17		
	17		
	17		
	16		
	14	17.8333	1.3844

Table 4
General Category Analysis of Errors

Type of error	Description	Examples
Visual Weakness	1. Sounds similar but is not correct	laf for laugh
Auditory Weakness	1. Error does not sound like original but is not bizarre	cerl for cruel
	2. Individual letter-sound confusions	bun for bin fog for frog sit for sift
Distortion of Sequence	Correct letters in incorrect order	pna for pan saw for was
Bizarre	Combines visual and auditory problems. No resemblance to the original	nfr for can

While screening and testing for the purposes of grouping and error analysis were being completed the children were introduced to typewriters so that they would be familiar with the teletype keyboard before training procedures began. Two weeks prior to the installation of the computer terminals in the schools a manual typewriter was given to each classroom. The children were asked to type the alphabet, their names and familiar words. Later, they were encouraged to include words and phrases from books in their typing. No set length of time was

stipulated for this practice period, however, each child was to have a daily opportunity for informal familiarization with typing.

Table 5
Specific Error Classification

Type of Error	Description	Examples
Omission	Single letter Syllable	supply for supply gentmen for gentlemen
Insertion of letters	Single letter Syllable	engeine for engine suddaren for sudden
Transpositions	Inversions-adjacent letters	agian for again
Doubling	Single for double Double for single	coffe for coffee reeporter for reporter
Confusions and substitutions	Single letters Syllables	climb for climb becus for because
Homophones		blew for blue fore for four
Perseveration		unclec for uncle latetest for latest
Plausible phonic alternative	Phonetically correct orthographically incorrect	wunts for once
Bizarre	No resemblance to the original	
No attempt		
Incomplete		

Equipment for the study included three teletype terminals linked by telephone to the Hewlett-Packard Time Shared Basic computer system at the University of Saskatchewan. One terminal was installed in each school used in the study and the twelve children in each school represented all three treatment groups. Eight part-time research assistants were hired to supervise the children's work over a five-week period.

An initial workshop was presented by Sask Tel to acquaint research assistants and interested teachers with the teletype terminal model used in the study. To further assist teachers in their understanding of the programs a manual was prepared and left in each school.

One of the reasons for choosing computer-assisted programs was to reduce the confounding effect of the teacher variable in the study. The roles of the research assistants were therefore restricted so that the program presentation and feedback to the child's responses came from the terminal.

Following introductory sessions each child was given fifteen minutes daily to work on his program. The majority of children obtained five hours and twenty-five minutes instruction over the duration of the study (see Table 6).

Table 6

Mean Number of Hours in Each Program

Number of Students	Number of Hours		
	Words	Letters	N Facts
12	6 hr. 5 min.	5 hr. 52 min.	5 hr. 58 min.

The study used a posttest only, control group design. Data were analyzed using a Lindquist Type I Analysis of Variance. The treatment groups were "Words" and "Letters." The control group was "N Facts." The subjects were divided into "V+" and "V-" groups on the basis of their visual memory skills (see Figure 1).

		Treatment		
		Words	Letters	N Facts
VSM Ability	V+	6	6	6
	V-	6	6	6

Figure 1. Study Design

Posttest scores from the Gates-McKillop Spelling Test Form B were used in this analysis. Errors made on this test as well as a posttesting of the S-S1A were compared with the errors made during the pretest period. In addition, further analysis was carried out using data from the tests mentioned as well as a posttest administration of the Schonell S-S1B and the VSM of the ITPA.

D. FINDINGS

Four null hypotheses were tested on the basis of information gathered in the study. All hypotheses were upheld. Although the average gain in spelling ability was 5.6 months for all groups over the five-week period, there was no significant difference in the mean posttest scores

of spelling achievement between the three treatment groups or between the V+ and V- groups, nor was there any interaction between treatment and visual sequencing ability. In comparing the pattern of errors made in pretest and posttest situations, no significant difference was found between the three treatment groups.

The Effects of Matching VSM Scores

In viewing the research results it is evident that the treatment groups which had been established by matching the subjects in threes according to their VSM scores did not, over the five-week period of the study, change significantly relative to each other in terms of their measured VSM scores on the ITPA. One computer program did not seem to contribute more than another to developing visual sequencing abilities, nor did the content of one of the three treatments produce significantly different VSM scores after five weeks of treatment (Table 11).

The V+ and V- groups which had been established by ranking VSM pretest scores remained significantly different after treatment. Both groups had higher VSM mean scores at the end of treatment.

Spelling Improvement Following Treatment

All treatment groups showed improvement in spelling as measured by the S-SIA test following five weeks of treatment, the overall mean gain in spelling age for all thirty-six children involved in the study was 5.6 months in five weeks. This substantial increase would not be expected with normal learning and maturation in such a short period

of time.

Statistical analysis of two posttest measures, the Gates-McKillop Form B and S-S1B indicated that differences between treatment groups were not significant. Children in the "N Facts" group, an Arithmetic program, learned to spell as well as their counterparts who were involved with spelling programs in the "Words" and "Letters" groups. There are at least three factors which might contribute to this uniform improvement in spelling skills in all treatment groups, both experimental and control.

The first factor to consider is that of the motivation and the resulting enthusiasm generated by the teletype terminals themselves. Motivation might be a satisfactory explanation of the marked increase in spelling ability over a short time period. It may be plausible to assume that the students' enjoyment for learning spread from their involvement with CAI to other aspects of their school experience. In following this line of reasoning, one solution is offered as to why those children receiving instruction in the subject area of mathematics would show an increase in their ability to spell.

The second consideration in viewing the posttest similarities in spelling abilities among the three treatment groups is the computer-assisted programs themselves. It is possible to entertain the assumption that the N Facts CAI program used by the "N Facts" group shared common characteristics with the Closur CAI program, used by the "Words" and "Letters" groups. In this latter consideration it would be necessary to conclude that the N Facts program developed the skills necessary in efficient spelling. In comparing the Closur and N Facts programs it is apparent that each program required the child to focus on the individual

elements of a sequence. In the Closur program, increasing numbers of letters were deleted from a word after a presentation of the entire word. The child was required to remember the individual components of the letter sequence and retain the position of that element within the sequence. In the N Facts program the child was asked to fill in the sum, difference, product or dividend so that it was always the last number in the sequence which was missing. Recognition and understanding of each component of the equation was necessary, however, before the solution could be formulated. The child using the N Facts program was required to focus on each element of the equation in a manner demanding concentration as the child using the Closur program was forced to focus on the individual components of the words by the deletions imposed by the program.

The third factor to be considered in viewing the posttest spelling abilities of all three treatment groups is the nature of the content of the individual treatments. Children asked to remember meaningful sequences of letters, nonmeaningful sequences of letters or number equations all improved in spelling ability. It would appear that the skills necessary for spelling are trained equally well by any of the three methods outlined. Attention to visual symbols, sequencing skills and immediate memory skills were requirements of all three treatments and each skill contributes to increased efficiency in the ability to spell.

The value of nonsense material is said to be that it compells the subject to perceive more carefully. Perhaps the emphasis on close examination of individual elements of a sequence was the common feature of the three treatments used. Either through content, as with the second order approximations or the number equations, or the format, as with the

Closur program and to a lesser extent the N Facts program, the children were compelled to observe detail.

The Contribution of Visual Sequential Memory to the Ability to Spell Efficiently

VSM ability, as measured by the ITPA did not contribute significantly to the determination of improvement in spelling ability. Further to this, a correlation matrix showed that all correlations between the five measures of spelling given in the present study were significantly positive, as was the correlation between pretest and posttest VSM, while all correlations between VSM and the administered spelling tests were negative.

It should be noted that while none of the negative correlations between VSM scores and spelling test scores was significant, the fact that ten out of ten correlations between these variables were negative at best casts doubt on the diagnostic value of the VSM of the ITPA in regards to spelling difficulty. This finding further reinforces the work other researchers who found the VSM subtest of the ITPA to be a questionable tool in testing visual memory as it functions in spelling. If further research confirms the finding of the present study that among poor spellers, sequencing ability with non-linguistic visual symbols is negatively correlated with spelling ability, important implications for the fuller understanding of cerebral functioning in spelling may emerge. Findings to date show that verbal material is more readily identified in the left hemiretina-left hemisphere, while the right hemiretina-right

hemisphere system is specialized to process nonverbal stimuli, e.g., geometric forms.

Types of Error and Changes in Error

The analysis of errors into general and specific error classifications was a substantial part of the study. In three of the four general categories outlining the errors made on the S-SIA no significant difference occurred in the pattern of errors from pretest to posttest. When analyzing the Gates-McKillop Forms A and B as to general category error, two categories showed no significant differences and in the classifications of bizarre and sequencing errors the response frequencies were too small to permit valid analysis.

Analysis of the change in error type from auditory to visual and from visual to auditory when comparing pretest and posttest errors yielded some surprising results. "Words" and "N Facts" treatment groups showed significant changes in error patterns made before and after treatment. The changes in error pattern made by the "Letters" group would occur fewer than ten times in a hundred by chance but as a significance level of $p < .05$ had been set, the change was regarded as not statistically significant. One may speculate as to whether these changes would have occurred if no treatment had taken place or whether the treatment influenced the changes. The apparent inconsistencies of the type of errors made by children over time as revealed by this analysis of changes in error may cast some doubt on the validity of typing children as displaying a particular modality weakness on the basis of a single test.

Further speculation leads one to question the reliability of the methods of analysis of spelling errors which have been proposed.

The Use of CAI in Remedial Programs

The teletype terminal presented a novel and exciting approach to learning for most children in the study. Some of the children's comments included the following:

Q: What did you like about the computer?

A: Typing those words. I liked to dial the thing. When you finish a word and then it goes on—that was cool. I like when on the thing it went "Hello". I like when it returns. I like when it makes the sound "beep" and RUN—go. I like how you shut it off.

A: The typing. I like taking my paper home.

A: I could remember those things you put on it. (This boy was in the N Facts group and made a considerable gain in his ability to do basic number facts.)

A: It tells you the answers.

A: I didn't get too many wrong. The letters weren't hard to find.

The positive comments of the children ranged from enjoying the content of the programs to being excited about the way the terminal operated. The enthusiasm of the children was evidenced throughout the program. Most of the students were as eager to work with the terminal at the end of the fifth week as they had been at the beginning of the first week of treatment. There were no children who said that they did not enjoy working with the terminals. There were, however, some criticisms of the computer when it "made a mistake" or "wouldn't work."

On occasion the terminals did not function because of interference on the line. This problem could usually be solved quickly by dialing in on another line. Some problems occurred, however, for which neither the Computation Centre or Sask Tel was willing to accept the responsibility. It was difficult for the person on the scene to judge whether the difficulty originated with the computer or the hardware and at times there was some juggling of the instructor from agent to agent before someone would attempt to rectify the problem. Improved communication between these two agents resulted in better service for the program as time went on. On the whole, Sask Tel provided prompt and efficient response to the instructors' distress calls.

Probably the most positive aspect of using CAI came with the realization that some of the children in the study who were discouraged regarding their academic difficulties, were able to engage in productive learning experiences which had a game-like quality. One little girl in particular showed a great deal of tension during the screening test. As the words became too difficult for her she did not attempt responses and became disruptive. She wrinkled her paper, tapped her pencil and shouted, "I hate this dumb test." Assigned to the "N Facts" group she showed no frustration during her sessions with the terminal. She would spend some time formulating her answer and then make a ritual of chanting, "Will I be right or will I be wrong?" while her finger circled the return button. In posttesting she attempted most of the words and her behavior indicated none of the frustrations evidenced in pretest measurements.

E. CONCLUSIONS AND IMPLICATIONS

1. Computer-assisted instruction in remedial programming offers an alternative manner of presenting material which is usually presented in some type of drill exercise. *Children involved with the study who were frustrated with failure in the classroom responded positively and with enjoyment to the challenge of the computer-assisted programs presented on the teletype terminal.* Children involved in the study did not seem to have a sense of failure when they made an incorrect response on the teletype terminal, rather, it was like a challenging game with the opportunity to try again.

Installed in the school the teletype terminal takes very little space and can service a number of individuals a day with each student involved in intense 10 or 15 minute periods. Even very young children can learn to "log on" and "log off" the terminal and, because the child's responses are immediately reinforced or corrected, teacher supervision necessary is minimal.

The cost of using computer-assisted programs is surprisingly low. The following breakdown indicates the costs involved in the study described. Actual in-school use of programs could involve more children in a longer day and thus lessen the cost per child.

a) Cost of Terminals:

(i) Cost per terminal:

Rental

Telephone	per month	\$ 9.50
Terminal	per month	<u>.55.00</u>
	Total	<u>\$64.50</u>

Installation

Service Connection	\$ 36.00
Total	<u>\$ 36.00</u>
Total	<u>\$100.50</u>

(ii) Cost per month for three terminals: \$301.50

b) *Cost of Computer Time*

Cost per day @ \$2.00 per hour \$ 8.00
 Cost per month @ \$8.00 per day \$160.00

c) *Cost of Instruction*

Cost per student per
 4 hour day (15 minute lessons,
 12 students) \$ 1.09
 Cost per student per month
 (4 hour day, 15 minute
 lessons, 12 students) \$ 21.88

2. Second-order approximations to English were found to be as useful as English words in improving spelling ability in the study.

Training children to remember the sequence of a number equation was as useful as teaching them to recall either meaningful or nonmeaningful sequences of letters in developing the skills necessary in spelling. Compelling children to observe detail in a sequence appears to be a useful remedial spelling technique. The study indicated that focusing on the detail of a sequence may be as useful as extending the sequence, at least with third grade children.

3. The VSM subtest of the ITPA did not appear to be a useful diagnostic tool in determining or predicting spelling ability. Consistent negative correlations were found in ten out of ten possible correlations between VSM scores and various measures of spelling ability.

While these correlations were not significant, the consistency of the negative correlations points clearly to the need for further investigation in this area. The non-verbal nature of the VSM subtest may be the crucial factor in producing negative correlations with spelling ability. Hemispheric laterality studies emphasize the fact that perception of verbal symbols and geometric symbols is controlled by different cerebral hemispheres. In the light of these findings use of the VSM subtest of the ITPA would seem questionable in diagnosing strengths or weaknesses pertinent to learning to spell.

4. Reliance on one test as a source from which a child's errors may be analyzed as revealing a particular modality weakness may be suspect. Significant changes in type of error were evidenced in the work of all three treatment groups of the present study over a five-week period. Errors which had been indicative of auditory weakness were replaced by visual weakness errors after five weeks and conversely words which were misspelled in such a way as to indicate a visual weakness on the pretest were replaced by auditory errors for the same child on posttesting. Two areas are opened to inquiry with this finding. The first is to question whether analysis of a child's errors as to modality weakness is a valid procedure when the basis of the classification is a single test. Next the reliability of established methods of analysis of spelling errors should be investigated more closely.